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ABSTRACT

Short and long-term retention in a visual recognition memory task was studied as a function of race using 39 10th grade inner-city high school students as subjects and random polygons as stimuli. It was hypothesized that a black subject confronted by an unfamiliar white adult and requested to take a test might be more aroused than a comparable white subject, and a related hypothesis was that all testing situations are more arousing to black than white subjects. A significant interaction of retention interval by race was obtained; for example, on the immediate test white subjects obtained higher recognition scores than black subjects while retention test recognition scores were higher for the black subjects on the one-week interval. These results supported an earlier hypothesis by F. H. Farley of arousal, memory, and the conditions of testing in black-white learning and memory research, suggesting in addition that the race of the experimenter may be crucial to the analysis of the black subjects' task performance. (Author/RB)

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EXPERIMENTER BY SUBJECT BY RETENTION INTERACTIONS: FIRST REPORT

by

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Report from the Program 1 Project: Operations and Processes of Learning

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Statement of Focus

Individually Guided Education (IGE) is a new comprehensive system of elementary education. The following components of the IGE system are in varying stages of development and implementation: a new organization for instruction and related administrative arrangements; a model of instructional programing for the individual student; and curriculum components in prereading, reading, mathematics, motivation, and environmental education. The development of other curriculum components, of a system for managing instruction by computer, and of instructional strategies is needed to complete the system. Continuing programmatic research is required to provide a sound knowledge base for the components under development and for improved second generation components. Finally, systematic implementation is essential so that the products will function properly in the IGE schools.

The Center plans and carries out the research, development, and implementation components of its IGE program in this sequence: (1) identify the needs and delimit the component problem area; (2) assess the possible constraints—financial resources and availability of staff; (3) formulate general plans and specific procedures for solving the problems; (4) secure and allocate human and material resources to carry out the plans; (5) provide for effective communication among personnel and efficient management of activities and resources; and (6) evaluate the effectiveness of each activity and its contribution to the total program and correct any difficulties through feedback mechanisms and appropriate management techniques.

A self-renewing system of elementary education is projected in each participating elementary school, i.e., one which is less dependent on external sources for direction and is more responsive to the needs of the children attending each particular school. In the IGE schools, Center-developed and other curriculum products compatible with the Center's instructional programing model will lead to higher student achievement and self-direction in learning and in conduct and also to higher morale and job satisfaction among educational personnel. Each developmental product makes its unique contribution to IGE as it is implemented in the schools. The various research components add to the knowledge of Center practitioners, developers, and theorists.

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Abstract

Short- and long-term retention in a visual recognition memory task was studied as a function of S race using 39 students as Ss and random polygons as stimuli. A significant interaction of race by retention interval was obtained, such that on the immediate test white Ss obtained higher recognition scores than black Ss, whereas on the one-week retention test recognition scores were higher for the black Ss; black Ss demonstrated reminiscence over the one-week interval. These results supported an earlier hypothesis by Farley of arousal, memory, and the conditions of testing in black-white learning and memory research, and suggested in addition that race of experimenter by race of S interactions and the choice of retention interval may be crucial to the correct analysis of black Ss' task performance.

I
Introduction

The role of motivational factors in human memory has not received a great deal of experimental study. Adams (1967) in a book-length treatment of human memory devotes a scant one-half page to the topic. It is often assumed that most persons tested in learning and memory studies are motivated to learn and that no special motivational influences are at work. Jung (1968) has suggested that "Since intentional instructions to learn are such strong motivators, it may not be possible to manipulate widely the level of motivation in verbal learning" (p. 27). That instructions to learn have powerful effects cannot be denied. However, it is probably true that much of the learning that occurs in a person's lifetime is not preceded by specific instructions to learn, and that motivational factors other than imposed intentional learning exhortations, such as curiosity, affect, and so on are involved in learning and memory. Many formulations in the area of motivation and memory have centered around Freudian-type repression analyses. Such repression formulations have been historically a major impetus in the area, but have led to few replicatable relationships. Work here has been plagued with problems of operationalization and clear theoretical prediction. The recent studies of Glucksberg and King (1967) and Weiner (1968) should be noted, however, as perhaps promising some solutions to these problems. Another somewhat related line of research that has recently received considerable attention has to do with incentive, reinforcement, and "intentional forgetting" in short-term memory tasks (Bjork, LaBerge, & Legrand, 1968; Weiner, 1968; Wickens & Simpson, 1968). This work is the most recent version of research into the effects of rewards and punishment and knowledge of results. However, because this work concentrates on very brief retention intervals of a few seconds, as in paradigms of the type used by Peterson and Peterson (1959), and almost exclusively uses shock (or threat of shock) and monetary incentives, the results of this research are probably of only limited generalizability to more realistic learning and memory situations.

Arousal or activation theory formulations, though of central concern to much of contemporary psychophysiology, have not been much studied in regard to human learning and memory. Where such research has been undertaken, however, a major view is that arousal changes during learning or input are significantly related to retention. When arousal changes during learning are monitored physiologically with these changes being related to presentation of individual items in a list, high arousal items generally show poor immediate memory but superior long-term memory relative to low-arousal items; the latter demonstrate relatively good immediate memory but "classical" forgetting over a longer term (Kleinsmith & Kaplan, 1964; Levonian, 1967; Lovejoy & Farley, 1969; Manske & Farley, 1970; McLean, 1969; Walker & Tarte, 1963). This finding is based on a within-S analysis. That is, items in a list are ranked, within-S, from high- to low-arousal response during learning, and the fate in memory of the high- versus low-arousal items for a given S is tracked over the short- or long-term retention interval. Other studies have utilized between-S designs in which various groups in an experiment are provided different treatments designed to induce changes in arousal level. Some treatments have employed white noise, drugs, and so on (Batten, 1967; Haveman & Farley, 1969; McLean, 1969). Though few studies of this type have been conducted, the results are less consistent than the within-S studies. Another approach to arousal and memory is essentially an individual differences approach. Can we treat S's prevailing arousal level in a test or learning situation as a traditional individual difference variable, such as intelligence? Such an "intrinsic arousal," as compared to induced arousal, approach (Farley, 1970b) is based on the notion of relatively comparable prevailing

arousal of a S from one learning or test situation to the next. The bulk of this work has utilized salivary response or personality scales as measures of intrinsic arousal (Berlyne & Carey, 1968; Farley, 1970a; Farley, Osborne, & Severson, 1970; Gaa & Farley, 1969; Howarth & Eysenck, 1968), and has with the exception of Berlyne and Carey (1968) demonstrated results with P-A learning and time of recall similar to those found in the within-S studies mentioned above. Thus, when Ss are selected on the basis of an "intrinsic arousal" measure, or when items are ranked within-S on the basis of their associated physiological arousal response, the interaction of arousal and time of recall in determining recall performance may be obtained. Exceptions to this general finding have been studies by Maltzman, Kantor, and Langdon (1966) and Schonpflug (1966); Farley (1970b) has argued that at least where the former study is concerned, context effects and the use of mixed lists can account for the discrepant results.

A question of great educational and social importance posed by some current learning researchers is whether basic learning differences exist between black and white children. Some differences in laboratory learning tasks have been reported (Jensen, 1969). The interpretation of these differences often centers on putative intellective or cognitive differences between black and white children (Jensen, 1969). This interpretation has in some instances led to genetic hypotheses. However, it is here suggested that motivational and situational variables may be important contributing factors. The present-day reliance on intellective and cognitive interpretations of learning differences and the so-called learning disabilities is likely exaggerated in that many of these differences may be functionally related to motivational factors (Burt & Williams, 1962; Katz & Cohen, 1962; Katz, Epps, & Axelson, 1964; Katz & Greenbaum, 1963; Zigler, 1969). Where black-white comparisons are concerned, much of the research has utilized white experimenters (often graduate assistants) to test both black and white children. This is particularly true of research conducted in the South (Dreger & Miller, 1968). Very little research is available that factorially combines the race of tester and testee (Sattler, 1970). Sattler and Theye (1967) concluded on the basis of the slight evidence available that "White experimenters may have some subtle deleterious effect on Negro subjects' scores, but the evidence is only suggestive" (p. 356).

Returning to the earlier discussion of arousal, it might be hypothesized that a black child confronted by an unfamiliar white adult and requested to take a test might be more aroused than a comparable white child. A related hypothesis might be that all testing situations are more arousing to black than white children. Advancing the hypothesis that arousal differences occur between black and white children in such a testing situation with a white examiner, it may be predicted on the basis of prior arousal and memory research that under such conditions, black Ss would demonstrate retention functions comparable to high-arousal conditions, while white Ss would demonstrate retention functions comparable to low-arousal conditions. That is, the learning deficit sometimes reported for black relative to white Ss would be restricted to the short-term retention test, and on a long-term test this difference would reverse. The present study was undertaken to test this hypothesis. In order to avoid as much as possible linguistic habit and experience differences between blacks and whites, verbal or pictorial paired-associate and other verbal learning and memory tasks widely used in black-white learning research (Rohwer, 1971) were not employed. Rather, a visual recognition memory task was used that consisted of nonrepresentational random polygons.

II
Method

Subjects

The subjects were 39 tenth-grade students from the inner core of a city of approximately one million population. Twenty were white and 19 were black, with seven males and 13 females in the former group, and eight males and 11 females in the latter group. Both black and white Ss were of low socioeconomic status (SES) as determined by school board delineations of the schools and areas involved, and both came from "inner core" schools, although the whites were from one school and the blacks from another.

Materials

The learning task was a visual recognition memory task consisting of nine random polygons. The polygons were constructed using the Attneave and Arnoult (1956) method 1, with complexity defined in terms of the number of sides or points varying at three levels--10, 28, and 80 sides. There were three different polygons at each of the three complexity levels, and these nine polygons represented the learning task. In addition, a further nine polygons, with three different ones at each of the same complexity levels (10, 28, 80) were used as buffers for the memory test. All polygons were mounted individually on 2-in. by 2-in. slides. The assignment of polygons, within complexity levels, as targets or buffers was random.

Procedure

The nine target, as opposed to buffer, polygons were first presented seriatim in a random order at a 5-sec. presentation rate. Immediate and one-week retention periods were employed, with Ss randomly assigned to one or the other condition. Thus a 2 by 2 independent groups design was employed (black versus white Ss, short-term versus long-term retention). The memory test consisted of the serial presentation of the nine target polygons plus the nine buffer polygons, with a random order of presentation of the 18 polygons at a 5-sec. presentation rate. A simplified signal-detection-type confidence-rating procedure was used as the memory task in which S indicated whether he had seen a given polygon before and how sure he was that he had seen it (0%, 25%, 50%, 75%, 100%).

Testing was undertaken by a white female university graduate student, unknown to the students tested, who had no knowledge of the experimental predictions.

III
Results

The five percentage steps (0%-100%) were assigned values of 0 to 4, respectively. The mean recognition scores based on all nine target stimuli for the black and white Ss at the immediate and one-week tests were: black immediate $\bar{X} = 1.97$, black one-week $\bar{X} = 2.48$, white immediate $\bar{X} = 2.67$, and white one-week $\bar{X} = 1.70$. The results of converting these means to correct percentage recognition are summarized in Figure 1. An analysis of variance was performed on the data summarized in Figure 1. This analysis is summarized in Table 1. From Table 1 it is clear that the interaction term was significant, although the main effects of race and retention interval were not.

TABLE 1
ANALYSIS OF VARIANCE OF THE PERCENTAGE CORRECT RECOGNITION SCORES AS A FUNCTION OF SUBJECT RACE AND RETENTION INTERVAL

Source	SS	df	MS	F
Race	0.02	1	0.02	0.022
Retention interval	0.58	1	0.58	0.65
Race x retention interval	5.42	1	5.42	6.08*
Error	31.15	35	0.89	
Total	37.17	38		

*$p < .05$.

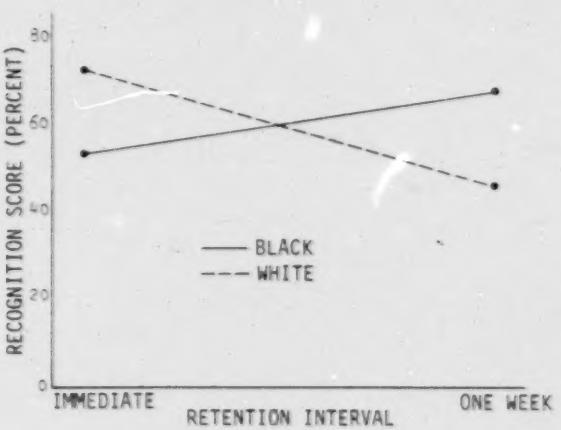

Figure 1. Short- and long-term retention as a function of subject race and retention interval.

IV
Discussion

The present results clearly are in line with much of the arousal and memory research reviewed, and suggest that the possibility of arousal effects be taken into account in experimental studies of learning and memory involving black and white Ss. Attention to the conditions of testing vis-à-vis the race of experimenter and race of subject is reinforced, as well as the choice of retention interval in such learning and memory research. The usual learning and memory study in this area has involved one session and relatively short time periods; on the basis of the present results, it is suggested that this procedure may be likely to generate misleading conclusions where black performance is concerned. Long-term retention tests may yield data not comparable to data from short-term tests.

These results do not, of course, definitively support the arousal, consolidation, and retention-interval hypothesis advanced earlier. There may be alternative interpretations of the data, although the reminiscence effect in the black Ss is hard to explain otherwise. Concerning the race of experimenter by race of S interaction hypothesis, one might question why the black Ss' performance was not depressed at the long-term test also, since the white experimenter was present then as well as at the short-term test. However, the results as obtained are in line with other work suggesting that arousal at time of retrieval is not significantly related to performance, whereas arousal during learning or input is significantly related to retention-test performance (Farley, 1970b; Kleinsmith & Kaplan, 1964). Accepting the arousal and memory interpretation, an important issue centers on arousal sources in the experiment. Was differential arousal during learning between black and white Ss due to the race of the experimenter, the personality of the experimenter, the nature of the task, or even the "intrinsic arousal" of the black Ss, with, it might be argued, the intrinsic arousal level of the black Ss being higher than that of the white Ss. Where the latter is concerned, there is suggestive evidence that black individuals may be generally higher in (intrinsic) physiological arousal level than whites (Bernstein, 1965; Brodsky, 1970; Johnson & Corah, 1963). Palermo (1959) has reported comparable manifest anxiety scale results, although other work has been reported in which no manifest anxiety differences were observed (Dreger & Miller, 1968). A point of concern to Berlyne (1971) was ". . . how far arousal level and how far arousal increment were the decisive factors" (p. 8). The Bernstein (1965), Brodsky (1970), and Johnson and Corah (1963) studies suggest arousal-level differences between blacks and whites. There is less evidence for arousal-change differences between blacks and whites under comparable conditions, although there may be such differential effects of the experimenter's race and/or personality (Sattler, 1970). As Berlyne (1971) has noted, "There are many reasons why black subjects might be susceptible to higher arousal in many situations, especially scholastic ones" (p. 8). Although the present results are in accord with our arousal hypothesis of black students' performance on such learning and memory tasks, the physiological evidence for such arousal differences is slight. Clearly a study is required that replicates the present procedures but factorially combines the race of the experimenter and the race of the S and continously monitors arousal physiologically during learning and retention tests. It would also be desirable to have more than one experimenter from each race and sex to attempt to reduce such nonracial effects as personality idiosyncracies, other physical characteristics, and so on. Use of the polygon stimuli would allow for studies with children at prereading levels, or life-span studies.

In addition to cautioning against studies that do not examine race-of-experimenter and race-of-subject interactions, the authors would caution against studies that do not separate

socioeconomic status from racial status. Much recent research with verbal learning tasks has confounded race and SES such that low-SES blacks are compared to middle-SES whites. Such research obscures the assessment of SES and racial factors in learning and memory.

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